

# Securing Energy for the Future — Renewable Energy in Alaska

Society of American Military  
Engineers

Regional Conference

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Presented by:

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Alaska Energy Authority



# Alaska Energy Authority

- Public corporation with Alaska Industrial Development and Export Authority
- Infrastructure Owner: Anchorage-Fairbanks Intertie, Bradely Lake Hydro, Healy Clean Coal Plant.
- Rural Energy Group: Tank Farm Construction, Power System Repair, Alternative Energy

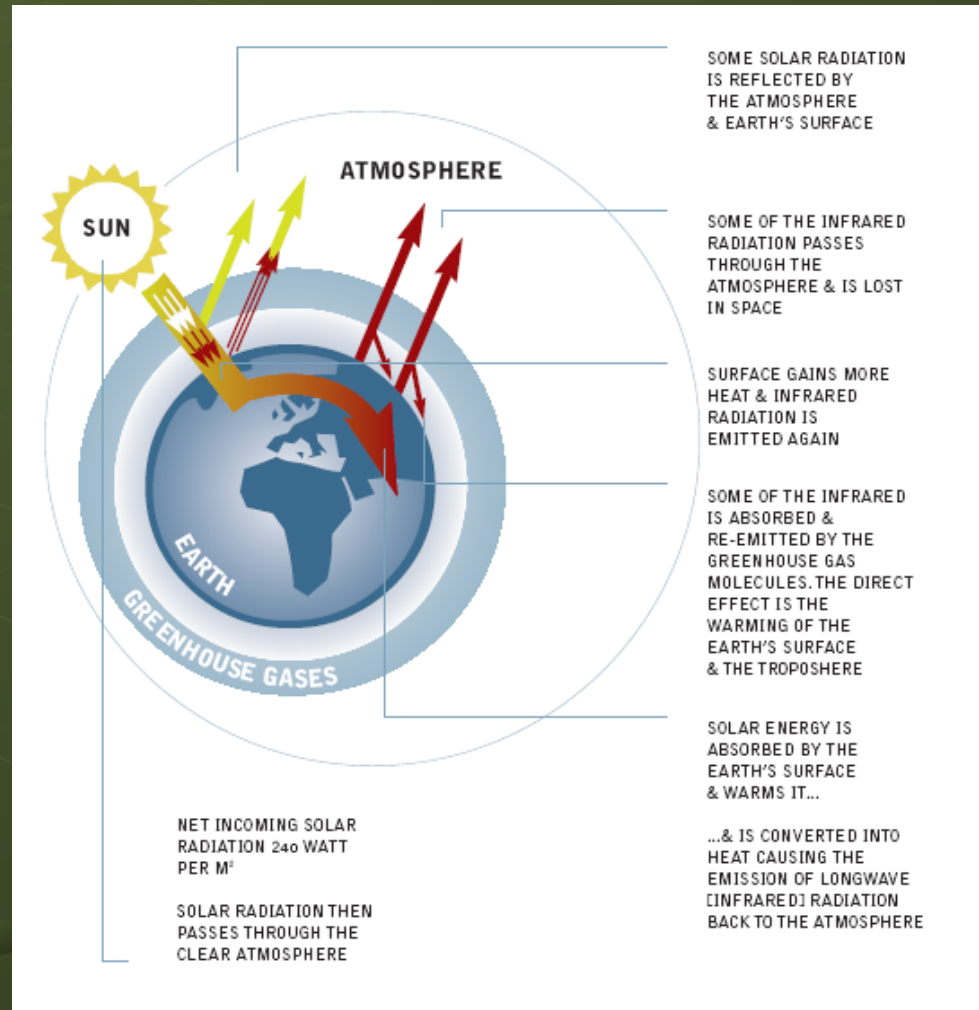


# What we'll talk about

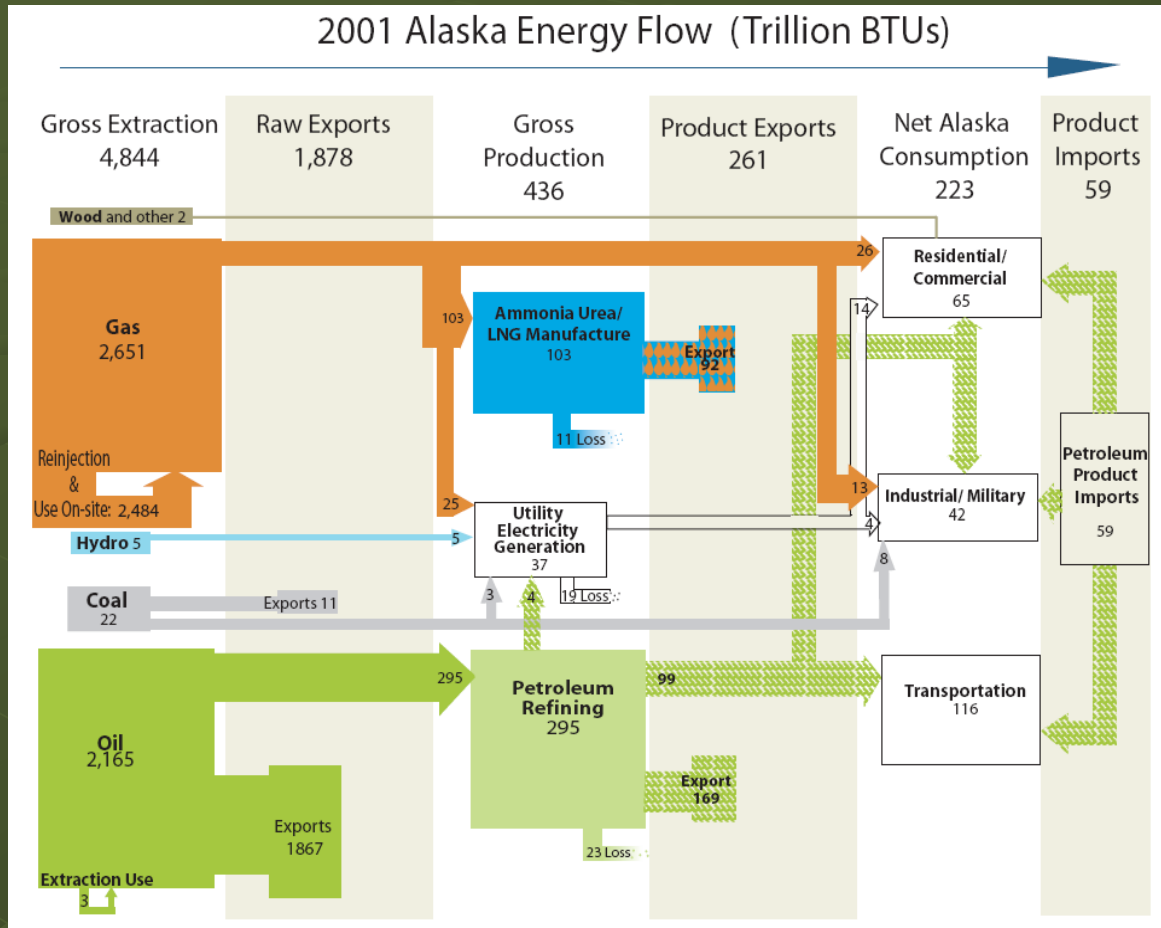
- Statewide Energy Issues and Planning
- Energy Efficiency
- Energy Conservation
- Hydroelectric
- Wind
- Biomass
- Geothermal
- Ocean Energy
- Solar



# Climate Change



# Statewide Energy Issues



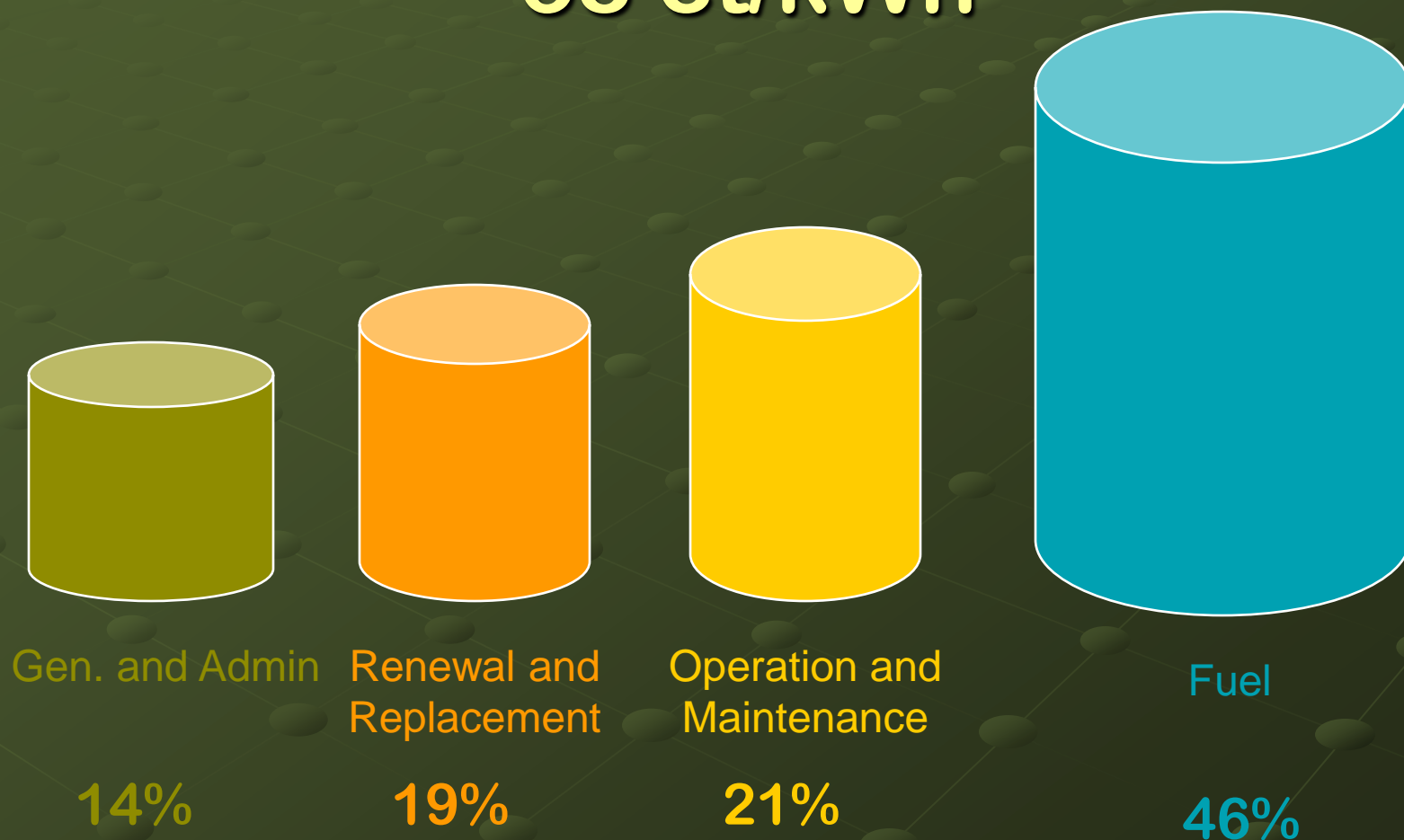
- In 2001 4.8 trillion BTU of energy were produced in Alaska

- Mostly from Oil and Gas

- About 85% of the oil Alaska produces is exported

- Alaska is importing about 30% of its exported refined petroleum back

# Breakdown of “Typical Village” Power Price 38 ct/kWh



# Rural Energy Plan

- Bulk Fuel
- Power Systems Upgrade
- Initiatives for Efficiency and Reliability:

Energy Efficiency and Heat Recovery

Energy Conservation

Renewable Energy

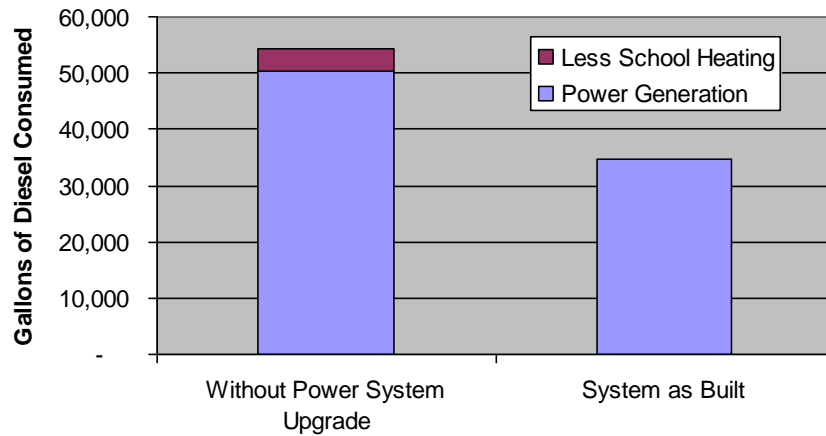
# Energy Efficiency



## Kokhanok: Power System Upgrade



Kokhanok Power System Efficiency FY05



# Energy Conservation

## Facilities:

- Audits
- Upgrades



## Homes:

- Weatherization
- Bulb, Appliance and Heating Upgrades

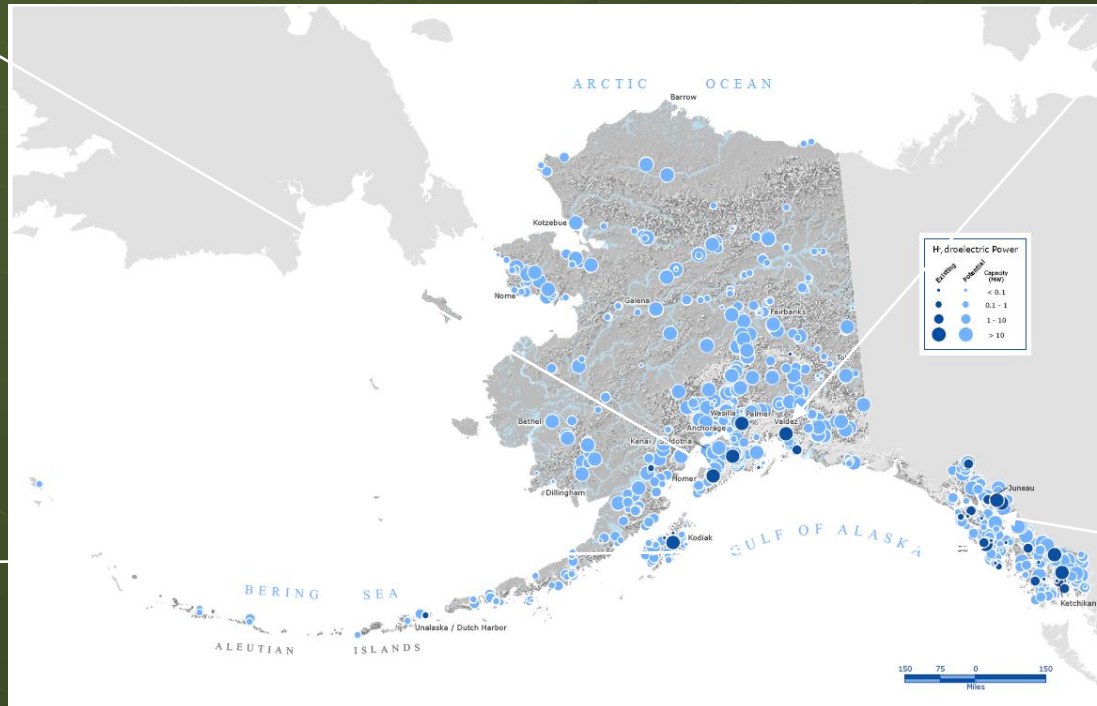


# Hydroelectric Power Resource



Bradley Lake  
120 MW

Terror Lake  
22.5 MW

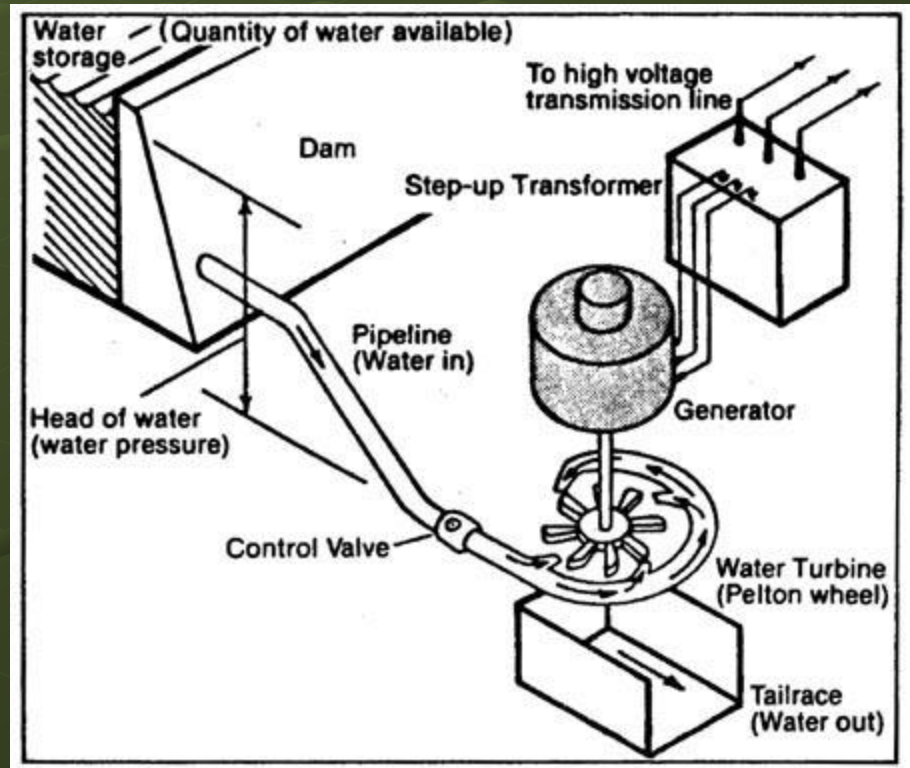
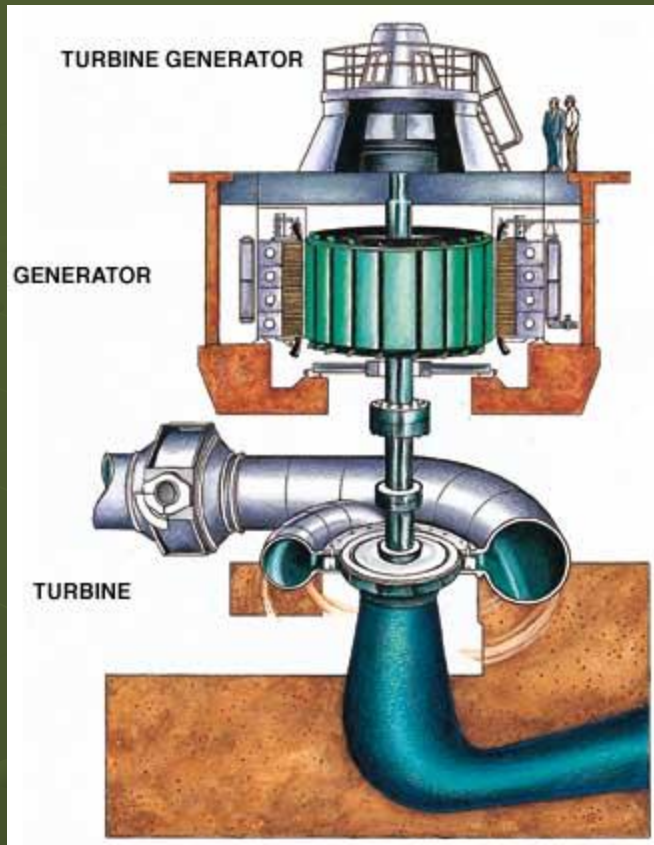


Swan Lake  
20M  
W

Tyee Lake  
20MW

24% of Electricity in Alaska

# Design



Copyright [Western Power Corporation](#)

# Small Hydroelectricity Projects

Atka



Old Town



Chuniisax Creek



Site Construction



Turbine



Generator Installation



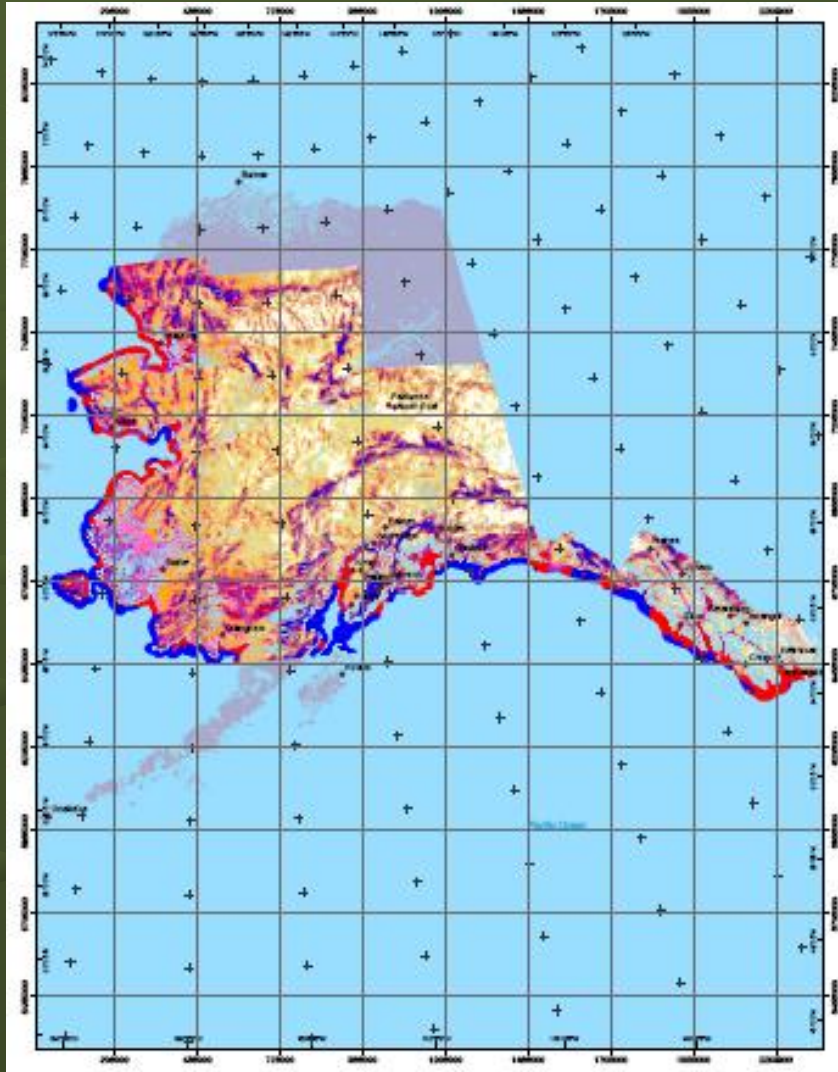
Completed Powerhouse

# Chitina



3,500,000 kWh per year

# Wind Resource



## Wind Class Areas:

- Poor-Fair: In-Land Areas (0-16 mph)
- Excellent: Coastal Areas, Y-K Delta, Mountainous Terrain (17-19 mph)
- Outstanding: Coastal Areas Mountain Ranges (18-20 mph)
- Superb: Coastal Areas, Aleutian Islands, High Mountain Tops, Offshore (over 20 mph)

# Wind Projects in Alaska

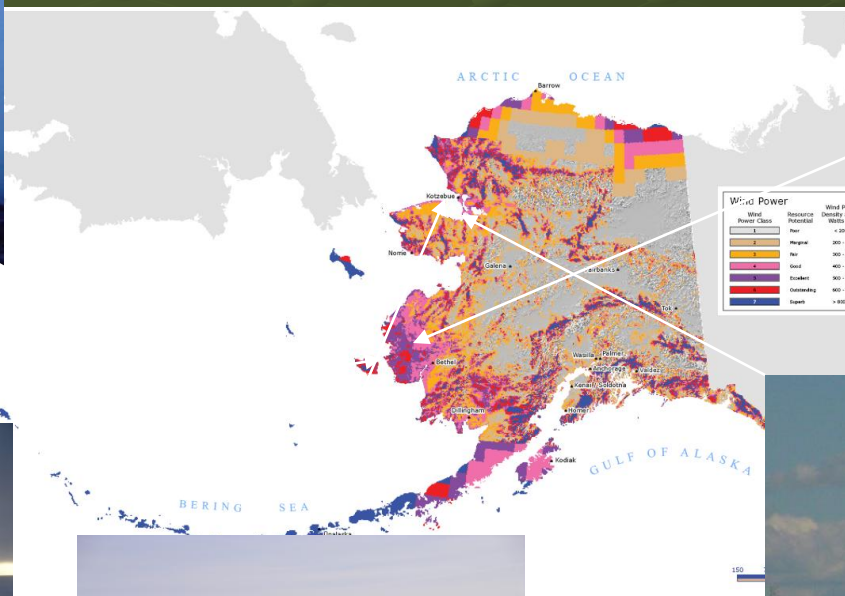
Total Installed Capacity  
3375 kW



St.Paul 775kW



Kasigluk 300kW



Toksook Bay  
300kW



Kotzebue 1000 kW



Selawik 260kW

# State Anemometer Loan Program

**AEA provides:**

- Tower kit
- Installation assistance
- Technical assistance

**Community provides:**

- Land use for 1 year of monitoring
- Installation assistance
- Maintenance
- Data collection



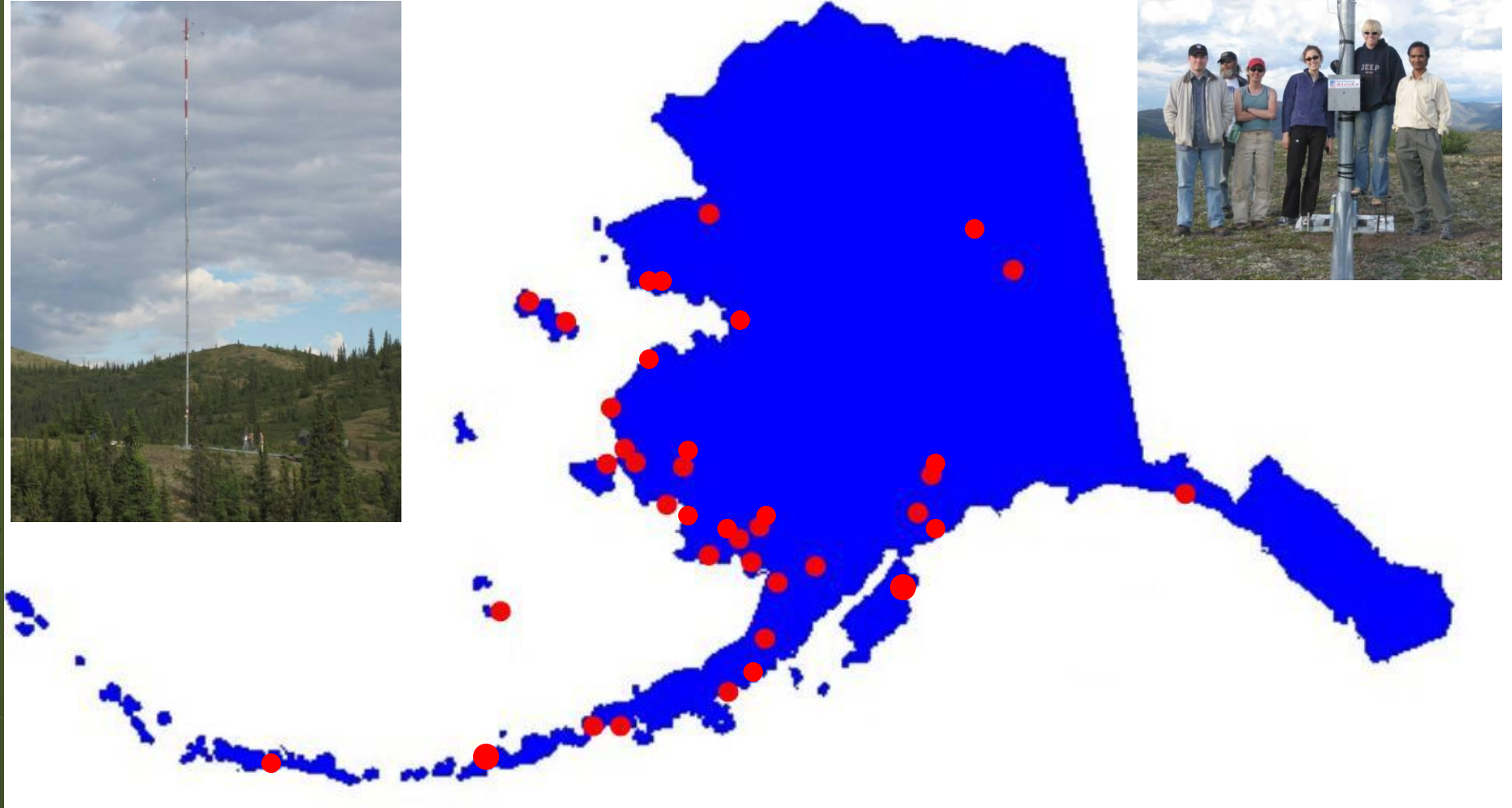
# Met-Tower Kit

Met tower kit includes:

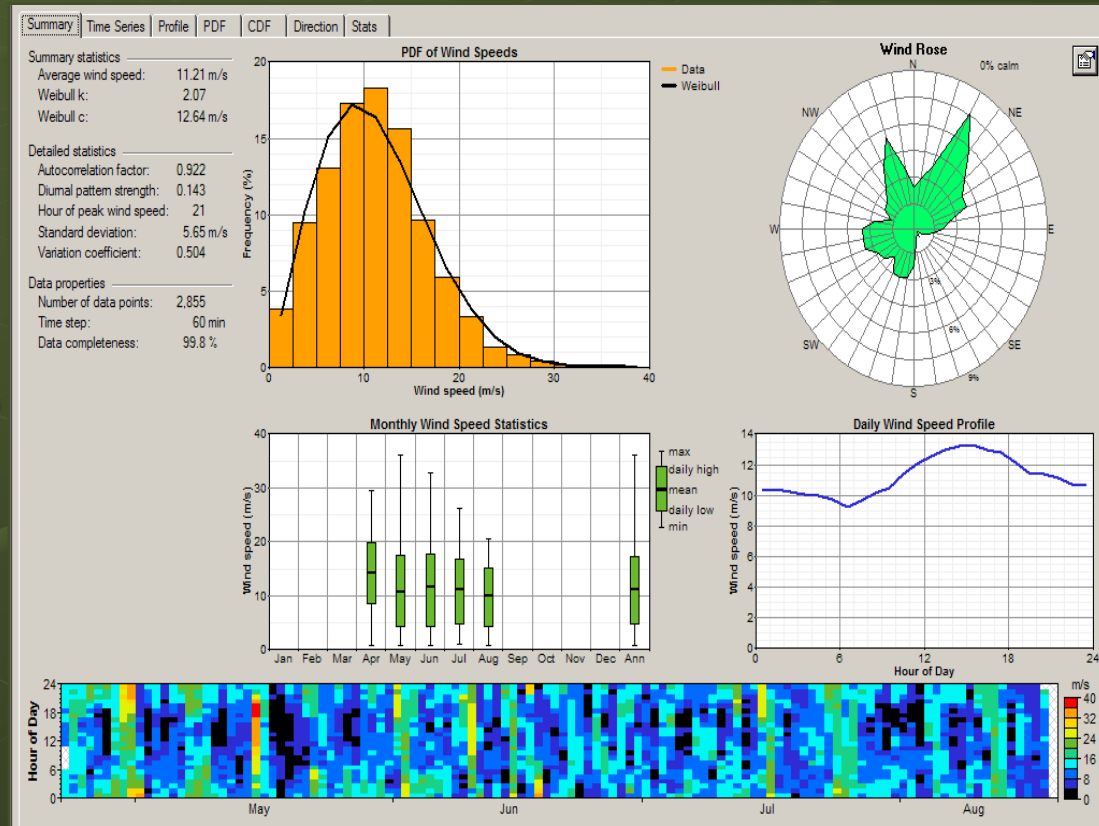
- Anemometers
- Wind vane
- Temperature sensor
- Data logger
- 100-foot tower



# Location of Meteorological Towers



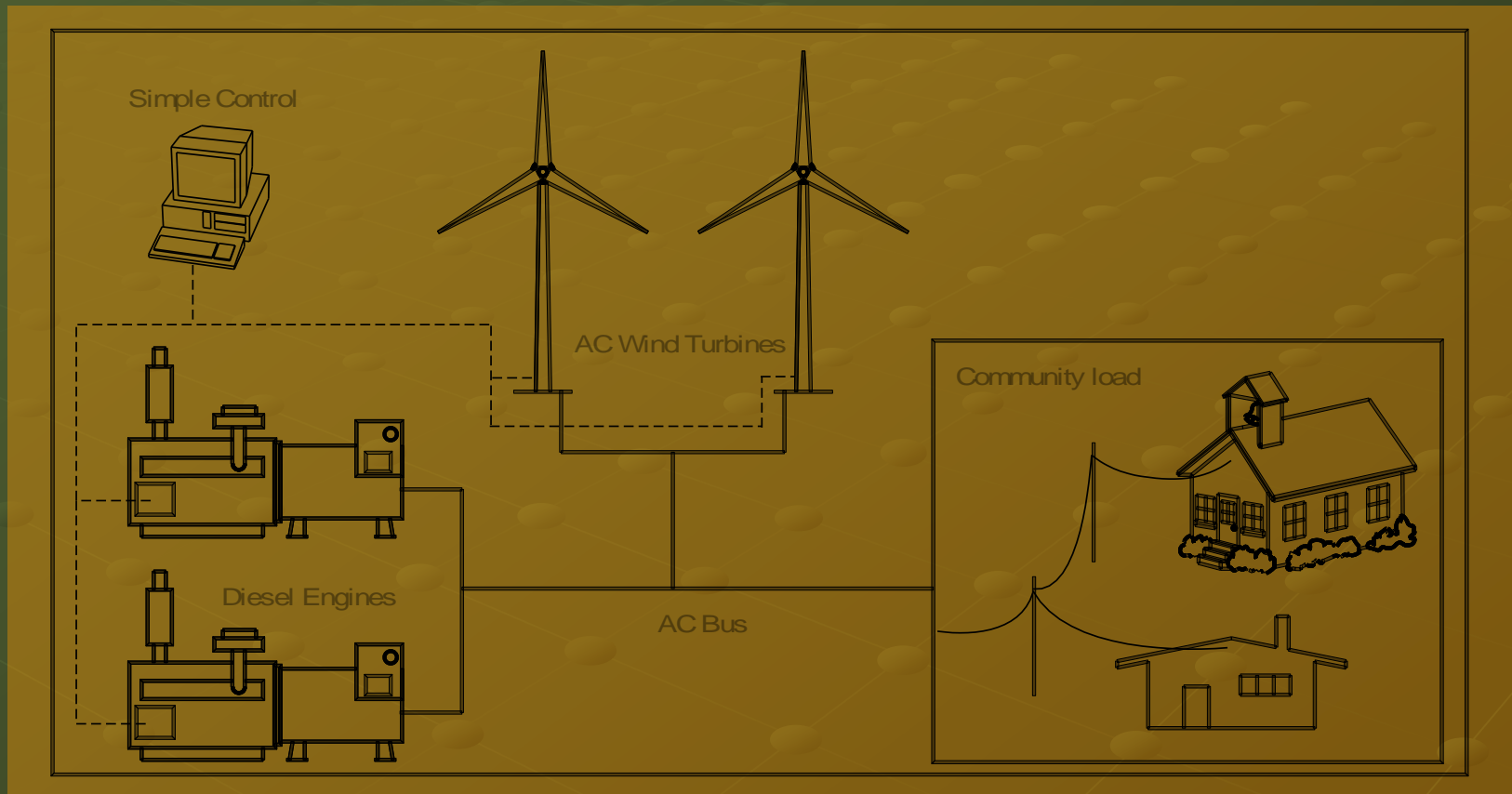
# Data Evaluation



# Wind Penetration

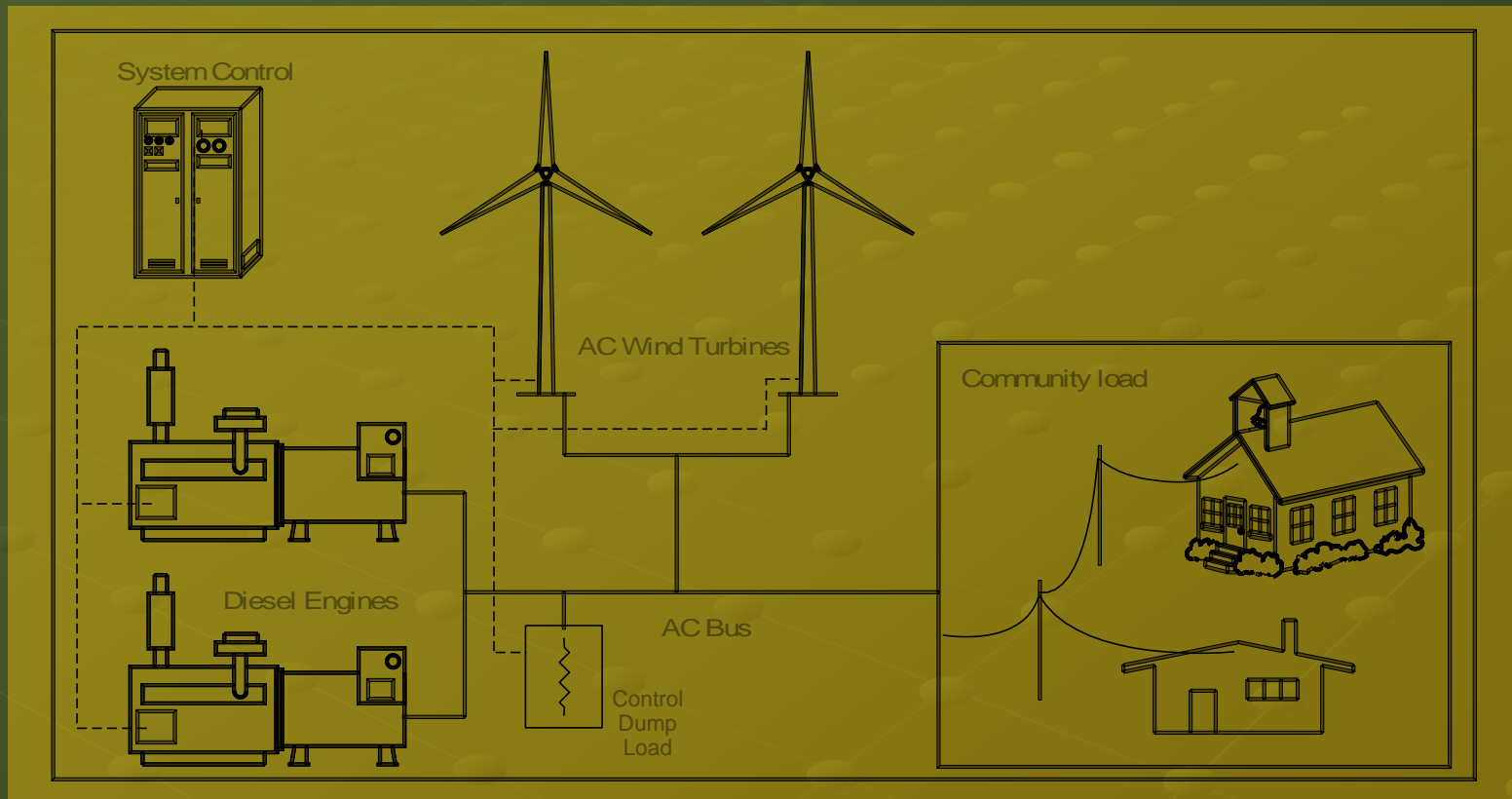
|                           | Low                | Medium  | High                          |
|---------------------------|--------------------|---|-------------------------------|
| <b>Peak Instantaneous</b> | <50%               | 50 – 100%   | 100 – 400%                    |
| <b>Annual Average</b>     | <20                | 20 – 50%  | 50 – 150 %                    |
| <b>Commercial status</b>  | Fully utilized     | Well proven<br>Fully commercial<br>Multiple use     | System prototype<br>Operating |
| <b>Examples</b>           | Denmark,<br>Greece | San Clemente, CA<br>Kotzebue, Ak<br>Coyaique, Chile | St. Paul<br>Wales Ak          |

# Low Penetration



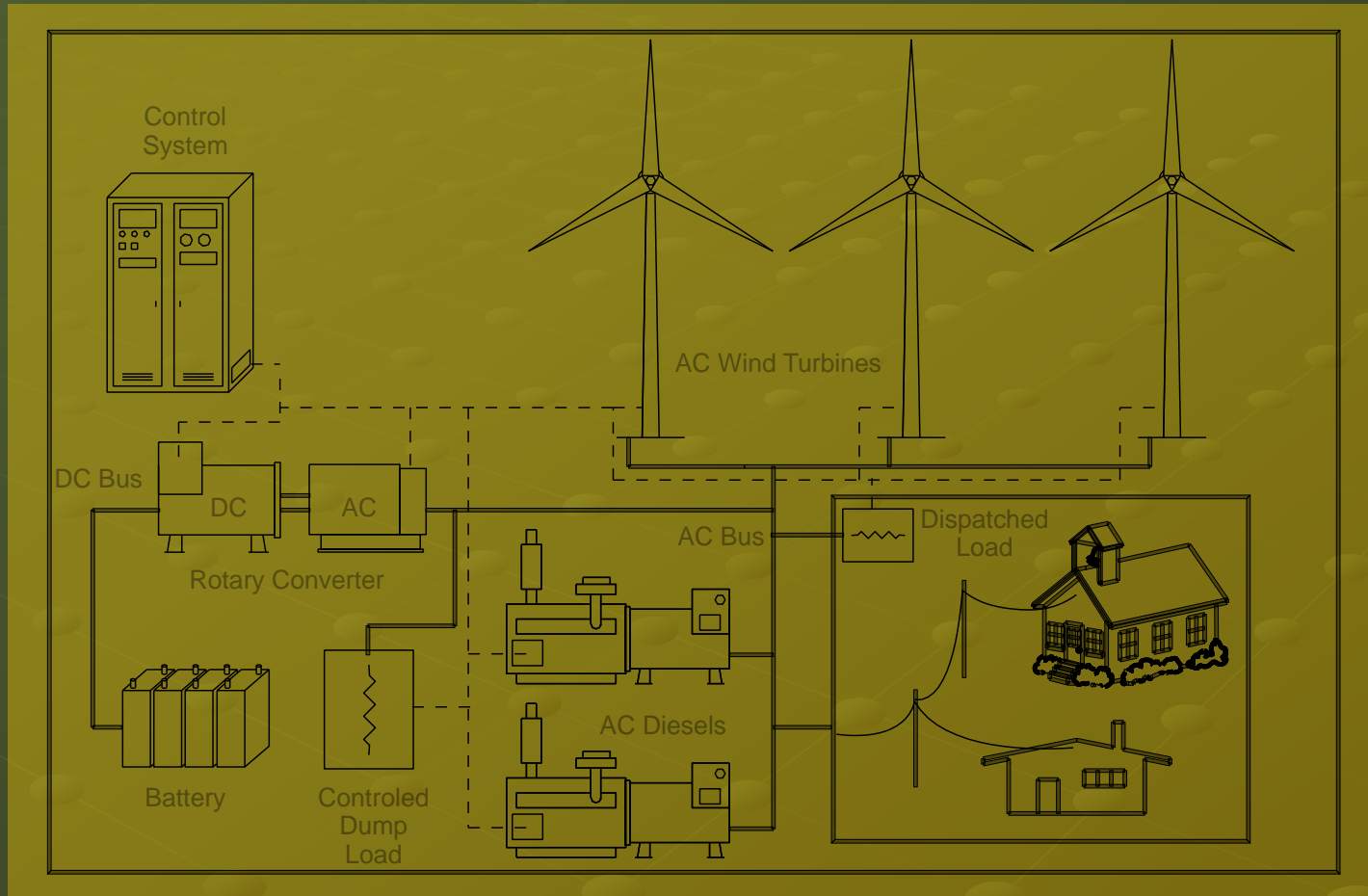
Source: NREL

# Medium Penetration



Source: NREL

# High Penetration



Source: NREL

# Wind Farm Construction

On March 29, 1999 Kotzebue Electric Association installed another AOC 15/50 wind turbine, one of a batch of seven that went up this past winter, more than tripling the size of the wind farm. Preparation for putting up these turbines took months.

All pieces needed to be transported to Kotzebue and the wind farm site and put together. Pilings were anchored deep in the ground to hold the towers. Control houses were built and electric wiring and controls installed.

Source: KEA





The bolts are tightened and the connection checked between the rotor blade assembly and the main turbine housing. Putting up the towers is an all-day process, in part because of the need to check and double-check items that would be difficult to fix once the turbine is lifted into place.



**Crew members attach heavy nylon straps from the crane assembly to the turbine.**



Lifting the tower



The tower is connected to a special hinge that rotates it onto its piling foundations as it is lifted



The tower is slowly lifted by the crane. Crew members stand watch at different angles to help direct the crane operator in keeping the tower straight



The tower is nearly vertical .



After the tower is vertical, the crew rushes in to secure it to the pilings. Here Steve Apgar (left) and Philip Stalker work on one piling. The process involves some welding and a lot of muscle to secure huge bolts with wrenches that are several feet long.



**Climb to release the hoist straps**



**Removing the nylon straps to release the tower from the crane.**

The tower stands on its own! This turbine will produce about 120,000 kilowatt-hours each year, about the amount of electricity used by 20 homes in Kotzebue. It will save about 9,000 gallons of fuel each year.



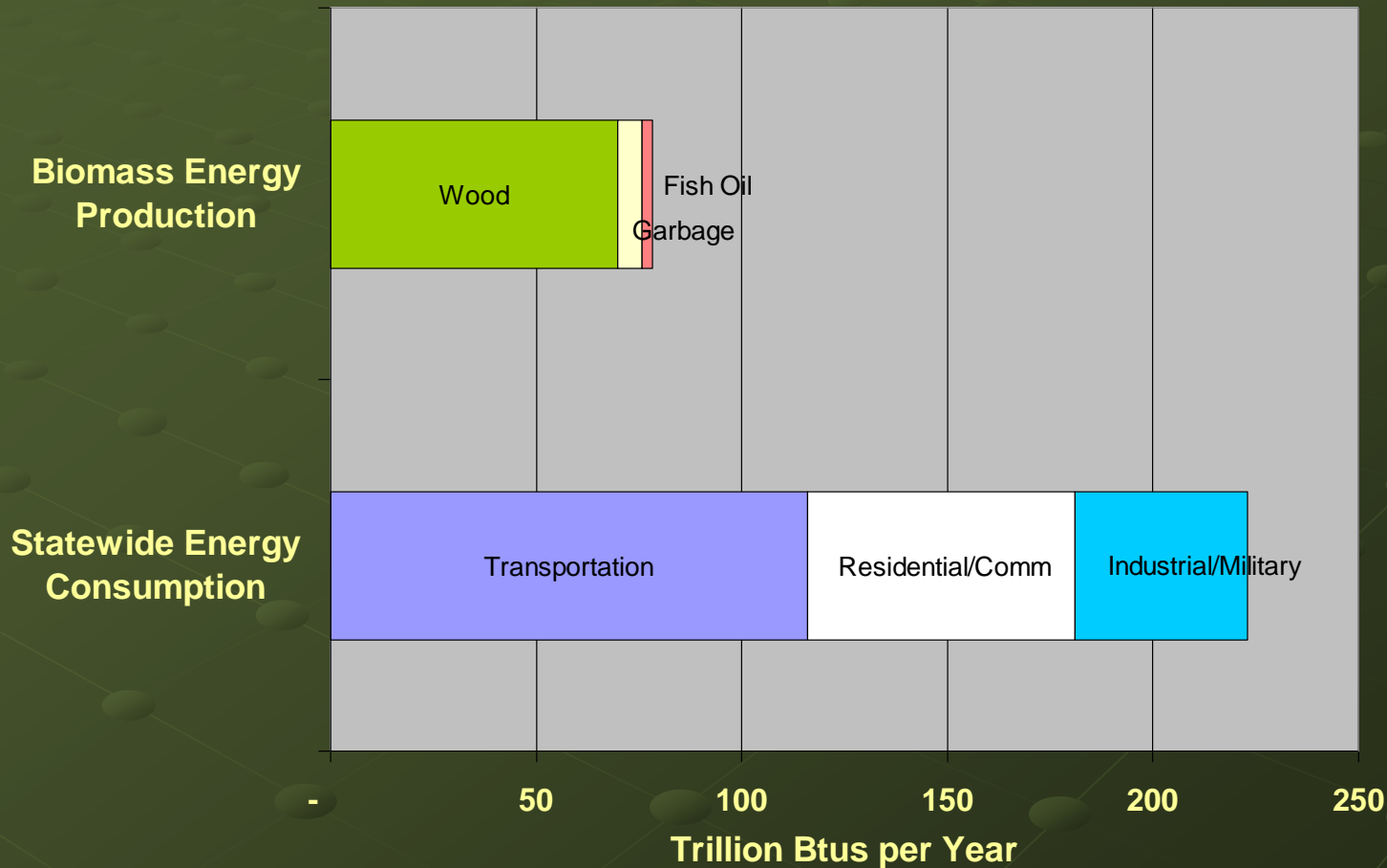
# Biomass



# Bioenergy Production

vs

## Alaska Demand



# Biomass Program

- Wood (heat, power, liquid fuels)
- Municipal Waste (heat and power)
- Fish oil (biodiesel and power)

# Wood



Photo : UAF Archives

Northern Commercial, Fairbanks



Alaska Pulp Co., Sitka 25 MW



Ketchikan Pulp Co., 38 MW

# Wood Energy Technologies

- Residential (“stick”) wood heating
- Stick-wood with thermal storage
- Pelletized wood fuel
- Chip/residuals boilers and heaters
- Gasification & pyrolysis
- Charcoal

# Wood Energy Projects

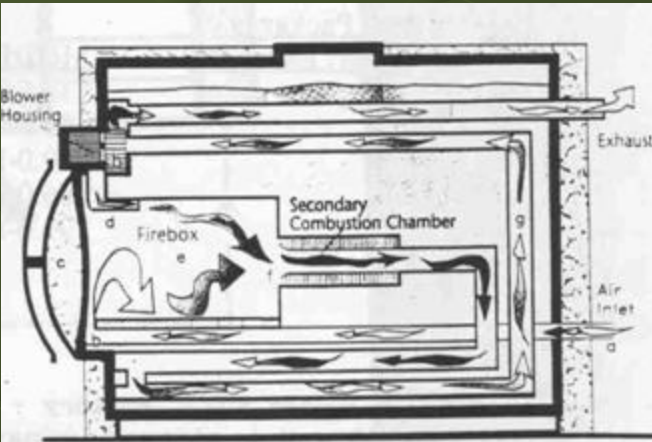
## Dot Lake

- Stick-wood fuel with thermal energy storage
- Slab wood from local sawmills
- Serves 9 residences with heat and hot water

## Craig

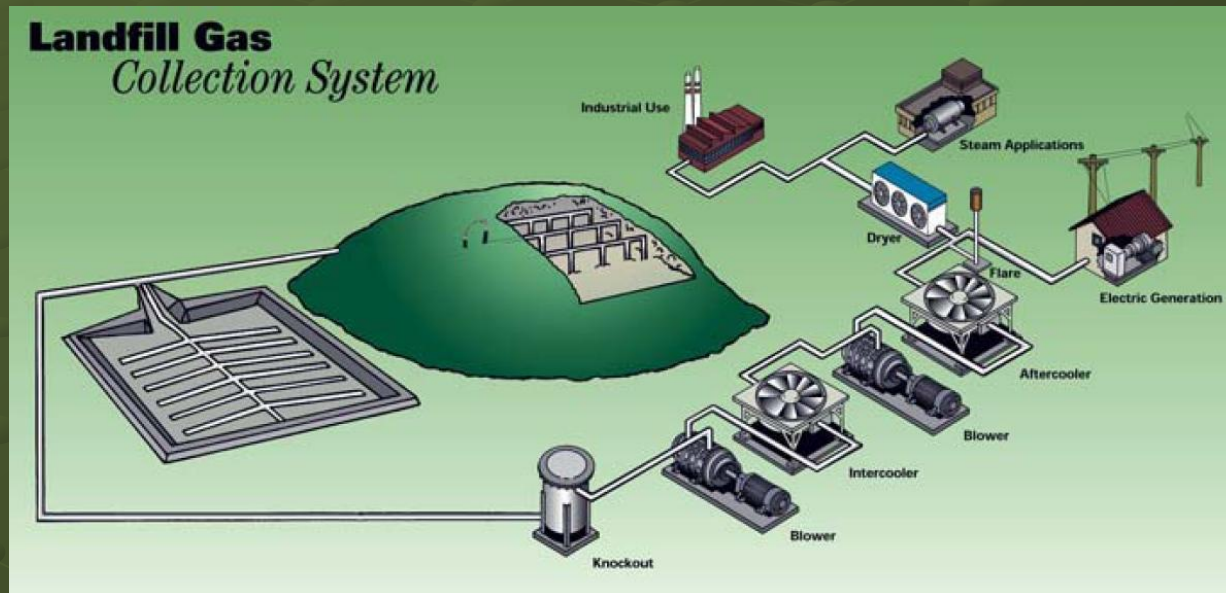
- Sawmill residuals (chips, sawdust, shavings)
- High School and community pool
- Construction starts spring 2007

# Dot Lake



# Landfill Gas to Energy

## Anchorage



Can provide about 2.5 MW – enough for  
2,500 homes  
Energy equivalent to 1.9 million gallons of  
diesel per year

# Fish Oil & Biodiesel

- By-product of seafood processing
- 8 million gallons produced annually
  - Most is used on-site as process boiler fuel
  - Some export sales to overseas markets
- Potential for 21 million gallons more
  - Unprocessed fish processing wastes
  - Full recovery is problematic



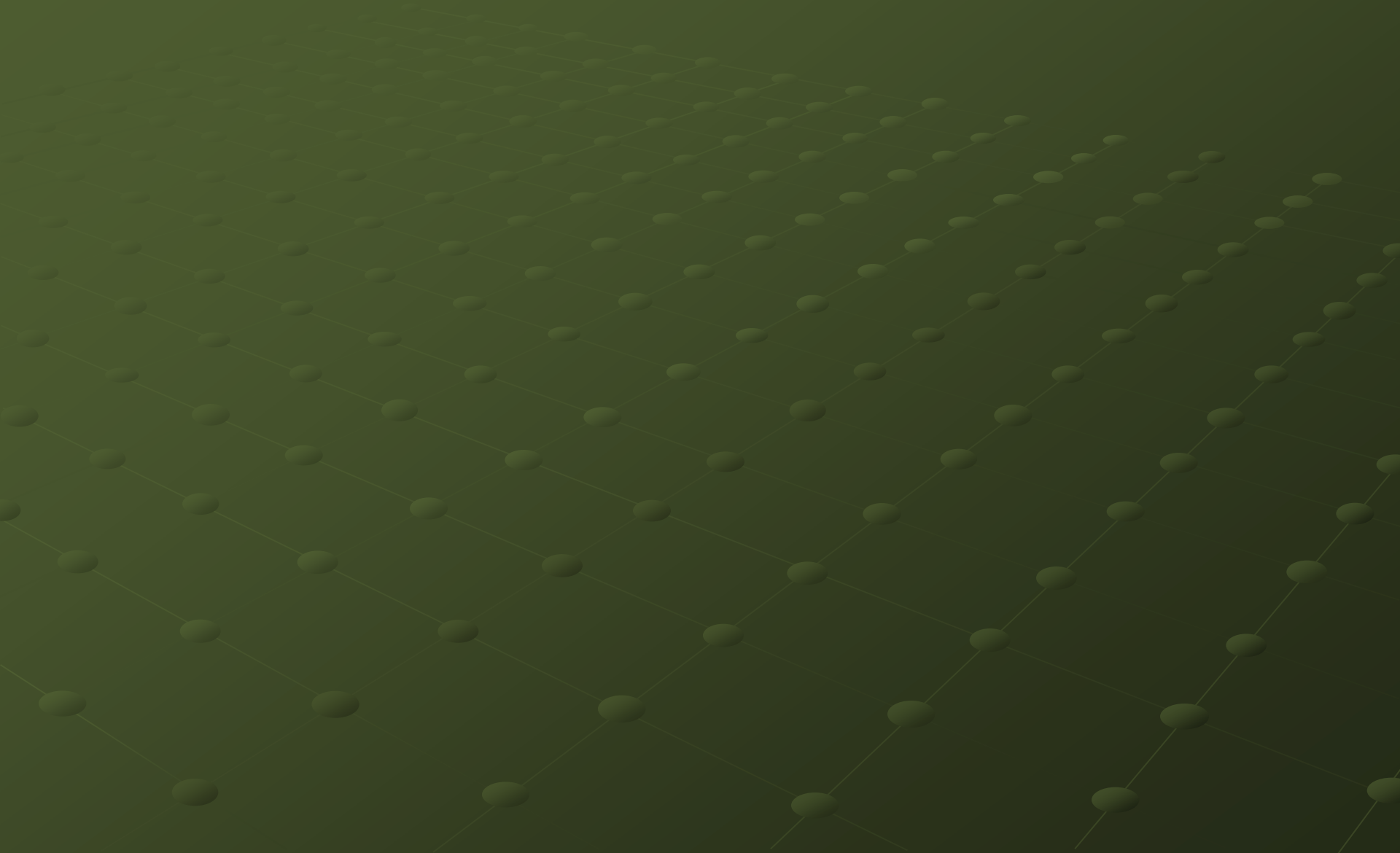
## Projects:

- “Neat” (raw) fish oil as diesel engine fuel
  - UniSea at Unalaska/Dutch Harbor using over 1 million gallons as engine fuel annually
  - Now widespread use within fishing industry
- Fish oil as biodiesel production feedstock
  - AEA & National Park Service
  - University of Alaska at Fairbanks

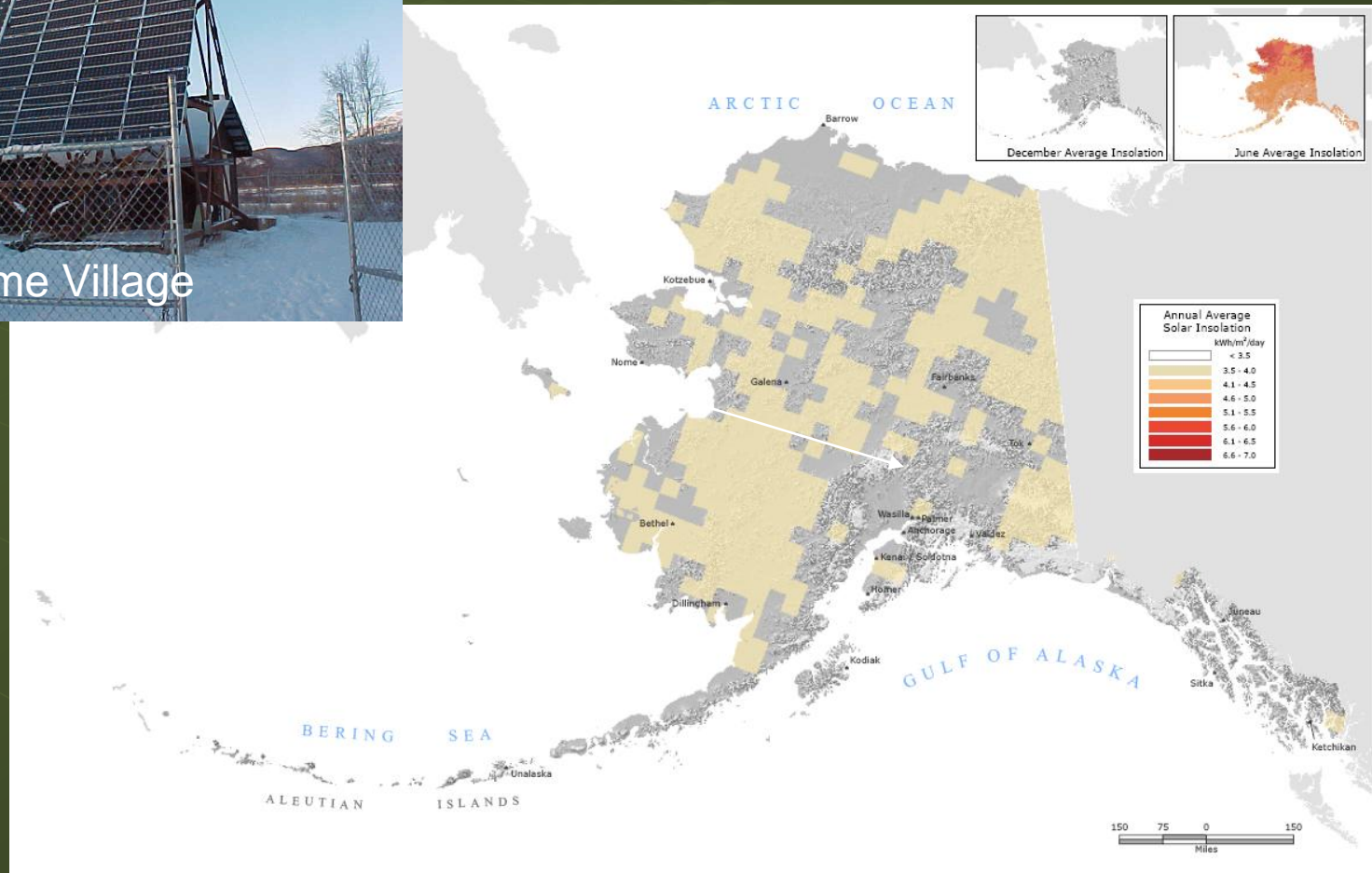
# Geothermal



# Ocean



# Solar



# Construction Issues in Alaska

## The Environment



# Wildlife



# Transportation



# Wrap-Up



# Thank you

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